IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:) Examiner: Christopher Findley
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CHIH-TA STAR SUNG ET AL.) Art Unit: 2621
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Application No.: 10/712,138)
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Filed: 13th, November, 2003)
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For: DIGITAL VIDEO STREAM DECODING METHOD AND APPARATUS
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RESPONSE

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
Dear Sir:

In response to the Office Action dated on 10th July, 2008. the Applicant respectfully submits the following other corrected "Claims" for allowance.

Respectfully submitted,

By: _____ Date: October 7th, 2008

Reply and explanation of the differences to the Official Action summary

Claims of the present invention do not relate to the video compression, instead to the decompression and more specifically on block by block decompression by detecting the block to block correlation between target block and previous blocks.

The main difference of claims of the present invention and the cited prior arts of Owen et al. US 6028635 and Wee et al. US 6697061: This invention is in video decompression mainly for reducing the computing times of "VLD" + "Inverse DCT", while, the two prior arts of Owen et al. US 6028635 and Wee et al. US 6697061 both are in "Video Compression" and focusing on reducing times of accessing the reference memory frame buffer (US 6028635) and reducing the computing times of "Motion Estimation and/or DCT" (US 6697061) as listed in the table below.

	Sung et al. of the Present invention	Owen et al. US 6028635	**Wee et al. US 6697061**
Main features / Key points	Reducing times of computing **"VLD" + "Inverse DCT"**	Reducing time of saving frame to memory buffer **"Re-compressing"** the decompressed pixels	Reducing computing times of "Motion Estimation" for "Video Editing"

"Claim 1" recites a new method for **decoding a video stream**:

1). Decompressing the video stream (VLD + inverse DCT + DeQuantization) and keeping the DCT bit stream of previously decompressed blocks of pixels into a temporary buffer for comparing to the targeted Block of pixel stream.

2). Incoming video stream equals to one of previously saved "Block" (DCT coefficient with VLC coded form) stream, then, the decompressed pixel values (differential values of a block pixels) will be used to represent the coming block.

We directly compare the video stream block by block to previous stream to identify the block which equals to previous block which needs no decompression procedure including ("VLD", "inverse DCT" and "DeQuantization").

Owen et al. US 6028635 indeed stores the decompressed pixels into the first memory as cited in Column 6 Line 34-38, and shown in Fig. 2 of Column 8, Line 39-41), Owen does not teach the spirit of comparing the current block to previously decoded blocks.

And in Wee 6,697,061 which indeed teaches motion estimation/compensation and DCT and inverse DCT (Column 4, Line 31-36 and Column 3, Line 47-55). But, the inverse DCT is for "Reconstructing" the compressed image as "Referencing Frame" for future Compression used or to identify image which does not have any editing in previous frame which does not teach this invention of "decoding video stream" and does not teach VLD, dequantization and inverse DCT for decompressing a vide

stream.

Applicant believes Claim 1 in the present invention needs to make clearer and needs to make more obvious difference to prior arts to avoid ambiguity.

Therefore, the Applicant respectfully submits you allow Claim 1, with the following updated Claim:

Claim 1: A method for decoding a video stream, comprising:

saving the coming block of compressed video data stream to the first on-chip temporary storage device, applying the variable length decoding method to decode the video bit stream and block by block recovering the DCT coefficients and dequantizing the coefficient by multiplying the quantization table and inverse transforming the DCT coefficients to matrix of pixel values;

saving the decompressed block of pixels into the second on-chip temporary storage device;

looking up incoming compressed block of pixel data to the blocks of received pixel data saved in the first temporary storage device and identifying whether any of the previous block is equivalent to the coming block; and

if a "Match" happens:

utilizing the block pixel data saved in the second temporary storage device corresponding to the matched block of bit stream to represent the block of

decompressed bit stream, and saving the decompressed block of pixels to a predetermined location of the second storage memory.

otherwise, decompressing the block of bit stream according to the normal decompression procedure and saving the decompressed block of pixels to a predetermined location of the second storage memory.

Therefore, the Applicant respectfully submits you allow Claim 1.

Claim 2: The present claim 2 teaches that only the block which does not find an equivalent block in previous blocks will go through the procedure of video decompression including VLD, dequantization, inverse DCT to reconstruct the block of pixels which is different from the quoted prior Owen et al. US 6028635. column 7, Lines 54-60 which teaches a typical procedure of block decompression no matter it find or not find an equivalent block of previous blocks. In Owen et al. US 6028635. **recompresses** the block before saving the reference block of pixels into the frame buffer to save the time of saving to memory which **does not have any similarity to this claim.**

Therefore, the Applicant respectfully submits you allow Claim 2, with the following updated Claim:

Claim 2: The method of claim 1, further comprising the steps of decoding the DCT bit stream and saving the decoded result **of block of pixels** into the second temporary storage device and saving the DCT coefficients into the first temporary storage device if the compressed block of block of pixels fails to match any of the previous blocks.

Claim 3: The present claim 3 teaches that only the block which does not find an equivalent block in previous blocks will go through the procedure of video decompression including VLD, dequantization, inverse DCT to reconstruct the block of pixels which is different from the quoted prior Owen et al. US 6028635 which teaches **"Re-compressing"** the block before saving the reference block of pixels into the frame buffer to save the time of saving to memory which does not have any relationship with this claim of comparing previous blocks of pixel data.

Therefore, the Applicant respectfully submits you allow Claim 3, with the following updated Claim:

Claim 3: The method of claim 2, further comprising the step of saving the decompressed result of DCT bit stream into an on-chip second temporary buffer.

Claim 4: The present claim teaches that only the coming block of DCT coefficients

finds an equivalent block in previous blocks will go through the procedure of video decompression including VLD, dequantization, inverse DCT to reconstruct the block of pixels which is different from the quoted prior arts quoted in **Wee et al. US 6697061** which teaches the saving of times of compressing the block pixels in motion estimation by comparing the motion vector of previous blocks for saving time of compression specifically in motion estimation which consumes most power of calculation which does not teach any of block comparison as in this claim of the present invention. Therefore, the Applicant respectfully submits you allow Claim 4, with the following updated Claim:

Claim 4: The method of claim 1, wherein the **coming** DCT input bit stream and one of the previous blocks of DCT coefficients are identical, then, the decoded block of pixels is used to represent the coming block.

Claim 5: The present claim teaches that if a tolerance of DCT coefficients of the block of pixels is set to allow some mismatch and saves time in decompressing the block data. Which is different from the quoted prior arts quoted **Wee et al. US 6697061** Column 5, Line 30-33, which teaches the saving of times of compressing the block pixels in motion estimation by comparing the motion vector of previous blocks for saving time of compression specifically in motion estimation which consumes most power of

calculation which discloses a method of compressing video with previously **edited or not edited** for reducing the computing times of motion estimation which does not relate t this claim which is focusing on the decompressing a block of DCT data is quite different from compressing which we do NOT relate to the prior art motion estimation or compression method.

Therefore, the Applicant respectfully submits you allow Claim 5, with the following updated Claim:

Claim 5: The method of claim 1, wherein the DCT input bit stream and the DCT reference bit stream are matched if a difference of the DCT input bit stream and the DCT reference bit stream is lower then a predetermined **tolerance**.

Claim 6: The present claim teaches that a neighboring block of pixels is equivalent to the target block. Which is different from the quoted prior arts quoted in **Wee et al. US 6697061** which teaches again, the saving of times of compressing the block pixels in motion estimation by comparing the motion vector of previous blocks for saving time of calculation, specifically in motion estimation which consumes most power of calculation as recited in Column 5 Lines 27-33 which discloses a method of compressing video with previously edited or **not edited** for reducing the computing times of motion estimation which does not relate t this claim which is focusing on the

decompressing a block of DCT data is quite different from the prior art motion estimation or video compression method.

Therefore, the Applicant respectfully submits you allow Claim 6, with the following updated Claim:

Claim 6: The method of claim 1, further comprising a step of representing a target block with a decompressed block pixels' within neighboring blocks if a compressed stream of the previously saved block in the first temporary storage device is identical to a target block stream.

Claim 7: The present claim teaches that a block difference is compared to the weighted difference of a neighboring block of pixels to determine whether it can be classified as a match. Which is different from the quoted prior arts quoted **Wee et al. US 6697061** which teaches again, the saving of times of compressing the block pixels in motion estimation by comparing the motion vector of previous blocks to see whether a match happened or not for saving time of calculation, specifically in motion estimation which consumes most power of calculation as recited in Column 5, Line 30-33 which discloses a method of compressing video with previously edited or **not edited** for reducing the computing times of motion estimation which does not relate t this claim which is focusing on the decompressing a block of DCT data.

Therefore, the Applicant respectfully submits you allow Claim 7.

Claim 8: The present claim teaches that a weighted block difference between the target block and a neighboring block is within tolerance to determine whether it can be classified as a match. Which is different from the quoted prior arts quoted in **Wee et al. US 6697061** (Column 8, Line 26-33) which teaches again, the saving of times of compressing the block pixels in motion estimation and the Examiner really teaches some sense in saving times of block video compression specifically in motion estimation only, but does not teach any idea in **decompressing** a video block of bit stream.

Therefore, the Applicant respectfully submits you allow Claim 8.

Claim 9: The present claim teaches that a weighted block difference between the target block and a previously decompressed block is within the tolerance to determine whether it can be classified as a match and using the decompressed data of the matched block to represent the target block. Which is different from the quoted prior arts quoted in Owen et al. US 6028635 (Column 7, Line 54 to Column 8, Line 6) or **Wee et al. US 6697061** Column 2, Line 32-37, which teaches again, the saving of times of compressing the block pixels in motion estimation in saving times of block video

compression specifically in motion estimation only, but does not teach any idea in **decompressing** a video block of bit stream.

Therefore, the Applicant respectfully submits you allow Claim 9.

Claim 10: Applicant agrees at canceling this claim.

Claim 11: The present claim teaches that the decompressed block is compressed again before storing to the on-chip temporary buffer. Which is different from the quoted prior arts quoted in Owen et al. US 6028635 Column 6, Line 34-38which or Column 8, Line 39-41 re-compresses the decompressed block of data and storing to a DRAM off-chip memory buffer to save the time of accessing.

Therefore, the Applicant respectfully submits you allow Claim 11, with the following updated Claim:

Claim 11. The method of claim 1, wherein **a block of** decompressed bit stream is compressed before **being stored to the second temporary storage** buffer for future representing new block stream. Owen et at does not teach this art, instead, it talks on the saving times of storing the recovered pixles.

Claim 12: the decompressed block is compressed again by a lossless compression

algorithm before storing to the on-chip temporary buffer. This method which will not create error or will not propagate the error to other frames, and is different from the quoted prior arts quoted in Oami et al. US 6363119 (Column 1, Lines 7-11) or **Owen** which teaches again, the saving of times of compressing the block pixels in motion estimation in saving times of block video compression specifically in motion estimation only, but does not teach any idea in **recompressing** a video block of bit stream. Oami et al. US 6363119 (Column 4, Lines 55-62) indeed teaches what the Examiner think an **obvious perspective** since most people only know the lossy algorithms. Even those few people do not necessary understand the value of applying a lossless compression algorithm to help further reducing the cost and die size of the on-chip secondary temporary buffer.

Therefore, the Applicant respectfully submits you allow Claim 12, with the following updated Claim:

Claim 12: The method of claim 1, wherein a block of decompressed bit stream is compressed through a lossless compression mechanism before being stored to an on-chip secondary temporary buffer and is decompressed for future representing a new block stream.

Claim 16 recites an apparatus of this invention of efficient video bit stream decoding

including three units: one to store the coming video stream and the decompressed previous stream of at least one block of pixels, another unit compares the new video stream to one of the previously decoded streams, and a selector choose the matched block of pixels to represent the new block.

In contrast, Owen et al. US 6028635 teaches only the popular apparatus of realizing the video decompression (Column 7, Line 54 to Column 8 Line 6)

In Column 8, Line 59 to Column 9 Line 5 teaches only "Re-compressing" the decompressed block before storing the an off-chip DRAM memory. **Wee et al. US 6697061** teaches mainly the video editing in saving times of motion estimation and does not teach the video stream decoding at all (especially it focuses on line 34-38 of "Video Editing" and distributing). In Column 4 line 31-36 teaches only saving of searching times in motion estimation, not video stream decoding as this invention of video decompression.

Applicant believes Claim 16 in the present invention needs to make clearer and needs a minor change to avoid ambiguity. Therefore, applicant respectfully submits you allow Claim 16, with the following updated Claim:

Claim 16: An apparatus for decoding a video stream, comprising:

a bit stream decoding unit including a VLD, variable length deciding and reconstructing the video bit stream to DCT matrix and a DeQuantization unit

multiplying the DCT matrix to inverse transforming and recovering the block of pixel matrix;

the first on-chip storage device for storing compressed video data stream and the second on-chip storage device for storing the corresponding decompressed pixel data of at least one previous block ;

a device comparing a coming compressed stream to at least

one previously saved stream; and

a device of selecting one of previously saved decoded blocks of pixel matrix to represent a target block if a target block is identical to one of the previously saved blocks.

Therefore, the Applicant respectfully submits you allow Claim 16.

Claim 17: The present claim teaches that the comparator used to decide whether a block match is found in previous blocks is used to select the matched block as the target block. Which is different from the quoted prior art quoted in **Wee et al. US 6697061** (Column 5 line 27-33) which teach again, the saving of times of compressing the block pixels in motion estimation in saving times of block video compression specifically in motion estimation only, but does not teach any idea in **comparing the block and selecting the result of a previous block to represent the targeted** video block of bit stream.

Therefore, the Applicant respectfully submits you allow Claim 17. with the following

updated Claim:

Claim 17. The apparatus of claim 16, wherein an output of a comparator is used to select the decoded pixels stored in the on-chip second temporary buffer to represent the target block pixels.

Claim 18: The present claim teaches that the matched block in previous blocks is copied to represent the target block. Which is different from the quoted prior art quoted in **Wee et al. US 6697061** (Column 5 line 27-33) which teaches again, the saving of times of compressing the block pixels in motion estimation by saving times of calculating the motion vectors in saving times of block video compression specifically in motion vectors only.

Therefore, the Applicant respectfully submits you allow Claim 18.

Claim 20 recites an apparatus of this invention of efficient I-type video frame bit stream or a still image JPEG image decoding. Neither Owen et al. US 6028635 nor **Wee et al. US 6697061** Column 2 line 32-37 teaches how the still image or I-type frame of a video stream leverages previous block of data for decompressing the intra-coded block of data.

Therefore, the Applicant respectfully submits you allow Claim 20, with the following updated Claim:

Claim 20. The apparatus of claim 16. wherein in decompressing an I-type frame or a